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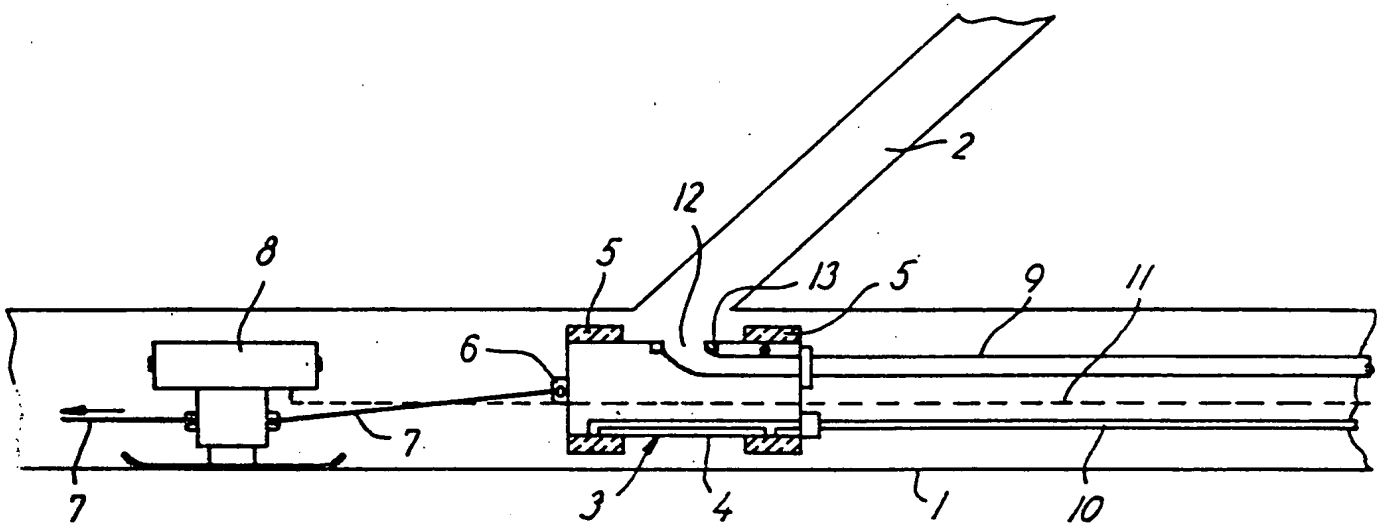

(57) Abstract

A method and an apparatus for the stopping and closing or plugging of unwanted side openings in sewage pipes (1), e.g. the plugging of disused side or branch pipes (2) of main sewer conduits, by which an apparatus (3) for supplying a sealing mass is conveyed through a sewage pipe (1), is positioned opposite an unwanted sideopening (2) and is made to supply sealing mass thereto. In order to obtain a lasting and durable stopping or plugging which is also resistant to attacks by rats, at least one orifice (12) adaptedfor supplying a concrete sealing mass, preferably a fibre-containing concrete sealing mass, is under pressure made to supply concrete mass to the side opening, particularly concrete mass to whichhas been added a preparation for discouraging rats and/or a rat poison.

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Method and apparatus for the plugging of side openings of sewage pipes, particularly side or branch pipes of main sewer conduits.

The invention relates to a method for the plugging of unwanted side openings in sewage pipes, particularly the plugging of disused side or branch pipes for main sewer conduits, by which an apparatus supplying concrete mass is conveyed through a sewer conduit, positioned opposite an unwanted side opening and made to supply concrete mass to this.

Side openings in main sewer conduits, particularly no longer used side or branch pipes, are harmful in several respects. They constitute leakages through which liquid matter can seep both into and out of the sewer conduit, but they are also very much used haunts for rats, e.g. as nesting sites, especially as there is direct and generally unimpeded access to the main sewer conduit, where rats can both obtain food and move to other branch pipes.

Till now difficulties have been experienced in the thorough plugging, i.e. from both sides, of, in particular, sewer branch pipes which are no longer used, e.g. as a result of the rebuilding or demolition of a house. It has not hitherto been possible to plug effectively an opening from a branch pipe into the main sewage pipe without digging operations. Such an unused branch pipe, still open at one end, is however a particularly suitable habitat for rats, partly because no sewage runs through it.

A technique of the kind dealt with in the introduction but for the repair of pipe leakages and according to which cement mortar is used as a sealant material is stated i Norwegian published patent specifi-

cation No. 137 291. This specification describes an apparatus which is conveyed through a sewer conduit and which is connected with a cement mortar feeder. This feeder discharges into a chamber whose inlet, which is connected with the concrete feeder, runs like a channel in the direction of the sewer conduit, and whose outlet, forming a sharp bend, runs at right angles hereto like a channel in the direction of the inner wall of a sewage pipe. Cement mortar or another sealant material having a suitable viscosity making it suited for feeding through tubes and channels is supplied under pressure through the two said channels and fed via the outlet to leakages such as cracks in the wall of the sewage pipe which is thereby sealed if the cement mortar sticks in the leakage. Since on account of the design of the apparatus with the two channels running at right angles to each other, the cement mortar must necessarily be comparatively thin, almost in the form of cement grout, it will stick in a leakage only if at least one side of the latter is of small dimension as is typically the case with cracks and fissures. Larger side openings such as e.g. side or branch pipes will not be able to be closed or plugged by the known apparatus because concrete mass having an extremely high viscosity is required therefor. If, for example, attempts were to be made to use the known apparatus to plug a branch pipe, the apparatus would have to remain outside the pipe opening for a very long time, e.g. 24-48 hours, in order to hold the concrete mass, thus resulting in a prolonged blocking of the sewer conduit and entailing the risk that the apparatus itself becomes firmly cast in the sewer conduit so that digging operations will still be necessary. If after a reasonably short binding period of e.g. a few minutes, a concrete mass is to stick firmly into a side or branch pipe which is e.g. perpendicular or slanting

downwards, e.g. for a metre, it must have such a high consistency that it can in no way be fed through the known apparatus.

A purpose of the present invention is to provide a technique permitting effective plugging of side or branch pipes with an extremely high-viscous concrete mass, preferably a fibre concrete mass.

For this purpose the method according to the invention is characterized in that at least one orifice adapted to supply a thick concrete mass, preferably a fibre-containing concrete mass, is under pressure made to supply concrete mass to the side opening, particularly the side or branch pipe.

An apparatus for plugging unwanted side openings in sewage pipes, particularly the plugging of unused side or branch pipes for main sewer conduits, and comprising an apparatus adapted for conveyance through a sewer conduit having means for positioning the apparatus opposite an unwanted side opening, particularly an unused branch pipe, and means for supplying concrete mass to the side opening is according to the invention characterized in that the means for supplying concrete mass comprise at least one concrete supply tube which at the concrete outlet under formation of a soft curve directs at least one orifice towards the inner wall of the sewer conduit.

The method and the apparatus according to the invention permit use of a very thick concrete for pressing into e.g. unused side or branch pipes, and even a fibre-containing concrete, which has a particularly viscous consistency, can be pressed in. Fibre concrete mass, particularly, has in addition to great strength an especially good adhesive ability on the inner wall of a branch pipe, because the fibres prevent a pressed in mass from falling out, even from an oblique or a perpen-

dicular pipe, it only being needed that the pressing apparatus remains opposite the pipe opening for a few minutes after the concrete mass has been pressed in. Thus, the apparatus can be removed so quickly that the concrete has for certain not hardened. Furthermore, fibre concrete has the particularly propitious quality in the present context that it does not settle, i.e. shrink during hardening, as ordinary concrete does, particularly a mass which - considered as a concrete mass - is a comparatively thin mass such as the one used in the aforementioned known technique.

The invention is explained below in closer detail, by way of example, with reference to the schematic drawing, in which

Fig. 1 shows an embodiment of an apparatus for plugging side or branch pipes,

Fig. 2 a detail of an apparatus as shown in Fig. 1,

Fig. 3 another embodiment of an apparatus for plugging branch pipes, and

Fig. 4 the apparatus shown in Fig. 3 seen from the end.

In Fig. 1 the reference 1 designates a sewer conduit, and 2 is a side or branch pipe thereto which is to be plugged.

An apparatus used for this purpose according to the present invention is in Fig. 1 generally designated 3.

This apparatus 3 is in the shown example composed of a pipe section 4 which at both ends is surrounded radially by an inflatable sealing ring 5, e.g. of plastic or rubber.

At one end, to the left in the figure, the pipe section 4 is connected through a draw eye 6 with a draw wire 7 which is connected with one side of a

slide carrying a TV inspection camera 8 for the positioning of the apparatus 3, and from the other side of which the draw wire 7 extends to a draw station from which the apparatus is conveyed through the sewer conduit 1 in the direction of the arrow.

At the other end of the pipe section 4, to the right in the figure, a concrete tube 9 and an air tube 10 and possibly also a TV camera cable 11 are led into the apparatus 3.

The concrete tube forms or is led forward to a radial opening 12 in the pipe section 4, and the air tube 10 is connected with the two sealing rings 5 as shown. The camera cable 11 is led through the apparatus 3 and on to the inspection camera 8. The other end of the cable 11 leads to an operation room, e.g. in a car at a drain-shaft.

When by means of the camera 8 the apparatus 3 is positioned opposite a side opening to be sealed or closed, e.g. opposite the branch pipe 2 which is to be plugged, compressed air is supplied through the tube 10 to the sealing rings 5 so that these are pumped up and pressed into tight contact against the internal wall of the sewage pipe. The ring-formed area of the sewage pipe 1 situated between the rings 5 is thereby shielded from the sewage which now flows through the apparatus 3, i.e. through the pipe section 4 so that the working of the sewerage system is not interrupted during the plugging work.

A thick concrete mass, preferably a fibre-containing concrete mass, to which a preparation for discouraging rats and/or a rat poison may advantageously be added is then fed through the hose or tube 9, and on account of the soft curve at the junction between the tube 9 and the orifice 12 this mass will be pressed out of the orifice 12. If the orifice 12 is opposite

the branch pipe 2, the concrete mass will in the main be supplied direct to this or, if the orifice 12 is not opposite the branch pipe 2, it will be dispersed along the external circumference of the pipe section 4 in the above-mentioned ring-formed area bounded by the sealing rings 5 and from there penetrate the branch or side pipe 2. This dispersion of the concrete mass along the circumference of the pipe section 4 can, if desired, be advanced by having the tube 9 under formation of a soft curve as shown in Fig. 1 open into an encircling channel 14 which is formed in the pipe section 4, see Fig. 2. If the diameter of the pipe section 4 is made to have suitable large dimensions in relation to a sewer conduit such as 1, it will then be able to be obtained that the concrete mass follows the encircling channel 14, not leaving it until opposite the branch pipe 2 into which it is pressed and which it closes. A minimum of concrete mass is hereby deposited on the interior wall of the sewage pipe, but the concrete mass can still be dispersed comparatively freely along the circumference of the apparatus 3 without any great loss of pressure in the channel 14. The pressing depth in the side opening 2 can therefore be considerable and the plugging correspondingly effective. In all cases an effective, lasting and durable plugging of the branch pipe 2 with concrete is obtained.

The concrete needs a certain time in which to harden, and it is therefore preferable to use a rapidly hardening concrete to which a plasticizer has also been added. Furthermore, it is advantageous that fibres are added to the concrete mass, e.g. carbon fibres, steel fibres, glass fibres or, especially, plastic fibres, or a mixture of such fibres. Such concrete mass has an augmented adhesive capacity and a considerably augmented

strength. The shrinkage of the concrete during hardening, which is slight beforehand, is further reduced.

The length of the fibres forming part of the concrete mass can, for example, amount to approx. 5 mm or more, e.g. 12 mm or more, and the fibre quantity can suitably constitute at least approx. 0,5 percentage by weight of the finished concrete mass, preferably however 1-2 percentage by weight or more.

The cement contained in the concrete should preferably be a rapidly hardening cement, the so-called rapid cement, which can advantageously be mixed with 10-20 percentage by weight of silica cement, e.g. 150 kg silica cement for 1000 kg rapid cement, and the quantity of sand can suitably constitute approx. 50% of the quantity of concrete measured by weight, e.g. 1000-1200 kg sand for the above-mentioned 1150 kg cement.

In the manufacture of the concrete mass the dry matter, i.e. cement, sand and fibres, e.g. in the weight ratio 35:20:1, can suitably be mixed together first, which can be done mechanical by means of a machine which operates according to the mixer principle, whereafter the liquid matter, i.e. water, to which is preferably added approx. 10-15 percentage by weight of plasticizer, is added, and the mixture is finished by stirring, which can also be done mechanical by means of a machine which operates according to the stirring or whisking principle, e.g. as a mixer.

The latter process, the addition of liquid matter, can if desired be carried out at the place of use.

A liquid matter quantity, e.g. having water and plasticizer in the weight ratio 8:1, of approx. 15-20 percentage by weight of the dry matter quantity has given good results.

In the manufacture of the concrete mass, cement, preferably rapid cement having a suitable content of

silica cement, and sand can be used alone as dry matter, and as liquid matter water can be used, preferably having a suitable content of plasticizer, to which before the mixing with the dry matter the fibres have been added so that before the final mixing of the plugging mass the fibres soak in the liquid matter and in a way become a component thereof. This foregoing soaking of the fibres has the effect that the finished concrete mass becomes particularly easy to work with, its penetration into a side pipe and its adhesive power therein are further increased, and an additional intensification of the strength of the finished plugging is also obtained. Here also it is possible to transport dry matter and liquid matter to the place of use separately and to carry out the final mixing in a mixer at the place of use.

As mentioned above, it is also advantageouse and moreover practical that a preparation for discouraging rats and/or a rat poison is added to the concrete mass, partly to protect the as yet unhardened concrete mass, partly to avoid unnecessary suffering on the part of rats which may have become trapped, e.g. in a plugged pipe.

For this purpose one can for example use a preparation by the name of metham, which both discourages rats on account of its odour, and emits a gas which quickly kills rats. This preparation, the use of which is permitted by the environmental authorities in several countries, can e.g. be added to the water before this is added to the concrete dry matter, or it can be added to the liquid concrete mass after this has been mixed with water.

Prior to the actual stopping or plugging process the concrete supply tube or pipe can also be moistened with water to which metham has been added, and if the

apparatus 3 is positioned opposite, for example, a disused branch pipe 2, the rings 5 are pumped up and the tube 9 is flushed with such metham-containing water, this will also penetrate the branch pipe and kill any rats that might be present. When the air pressure is then removed from the sealing rings 5, the flushing fluid or at least a part thereof will run out, but the branch pipe will still be moistened with the fluid and any remaining flushing fluid will not be able to interfere with the subsequent concrete feeding and plugging, impede the hardening of the concrete or wash away the concrete before it has hardened.

In the embodiment shown by way of example in the drawing only one concrete supplying orifice 12 is shown in the apparatus 3, but it will be seen that there can as a matter of course be provided a number of orifices distributed along the circumference of the pipe section or along the channel 14 which can be made to supply concrete mass or fibre concrete mass, in dependence on which orifice or orifices are positioned most directly opposite the opening to which concrete mass is to be supplied.

Another possibility is a pipe section 4 rotatable in relation to the sealing rings 5, which section can be telecontrolled from the operation room with the assistance of a TV camera by means of a small electric motor, e.g. a step motor, with a view to directing the orifice 12 direct against the side opening 2. In this case an alectric cable must also be led from the apparatus 3 to the operation room in order to feed the electric motor.

In most cases the shown embodiment of the apparatus 3 with pipe section 4 and up to four concrete-supplying orifices 12, has proved to be sufficient. The excess concrete is wiped off by a scraper, not

shown, or by the posterior sealing ring in the direction of travel and is carried to the draw station where it is collected.

At the supply tube or pipe 9 for concrete mass which is of a flexible material, the pressure in the concrete mass can be supervised by means of pressure sensors, e.g. pressure transducers which are preferably mounted in the proximity of the orifice 12. These transducers 13 are electrically connected to the measuring equipment in the operating room.

Figs. 3 and 4 show another embodiment of an apparatus according to the invention for plugging side or branch pipes.

The concrete supply tube 9 is led through a merely adumbrated, tube-formed part 15 which bears the one sealing ring 5, and under formation of very soft curves the tube 9 terminates into three orifices 12, 12' and 12", only two of which, 12 and 12', are visible in Fig. 3. At each of the orifices 12 there is suitably a curved flange 16 which serves as a runner. The flanges 16 have the additional function that they further reduce the risk of concrete, especially fibre concrete, which is pressed into a branch pipe, being partially drawn out of this when the apparatus is pulled away. The flanges 16 reduce - possibly to zero - the concrete contact surface between the branch pipe and the space between the parts 15.

To the three pipe ends forming the orifices 12 is attached, e.g. welded, in the design example a slab 17 in which is formed a hole which receives one end of a bolt 18 which is held in place by means of a nut 19 and which at its other end is connected with another part 15 bearing a sealing ring.

The diameter of the bolt can suitably be slightly less than the diameter of the hole in the slab 17. The

hereby produced clearance provides a certain flexibility - or hinge effect in the connection between the bolt 18 and the slab 17, and it becomes possible for the apparatus also to pass bends or places where two sewage pipes are slightly displaced in relation to each other.

20 in Fig. 3 designates an air tube which connects the two sealing rings with each other.

One of the three orifices 12 will almost always be opposite or approximately opposite a branch pipe to be plugged, but if not concrete mass from all the orifices will merely be pressed out into the space between the parts 15 and, when this space is filled, will force its way from there into the branch pipe. This is possible on account of the very slight loss of pressure in the soft curves at the branchings from the main supply tube 9.

PATENT CLAIMS

1. A method for the plugging of unwanted side openings in sewage pipes (1), particularly the plugging of disused side or branch pipes (2) for main sewer conduits, by which an apparatus (3) supplying concrete mass is conveyed through a sewer conduit (1), positioned opposite an unwanted side opening (2) and made to supply concrete mass to this, characterized in that at least one orifice (12) adapted to supply a thick concrete mass, preferably a fibre-containing concrete mass, is under pressure made to supply concrete mass to the side opening, particularly the side or branch pipe.

2. A method according to claim 1, characterized in that a rapidly hardening concrete, preferably a rapidly hardening fibre concrete, is used as concrete mass.

3. A method according to claim 1 or 2, characterized in that there is used a concrete sealing mass to which a preparation for discouraging rats and/or a rat poison has been added.

4. A process acording to one or more of claims 1-3, characterized in that prior to the supplying of concrete the side opening (2) is flushed with water to which has been added a preparation for discouraging rats and/or a rat poison.

5. An apparatus for the plugging of unwanted side openings in sewage pipes, particularly the plugging of disused side or branch pipes of main sewer conduits, using the method according to one or more of claims 1-4, comprising an apparatus (3) to be conveyed through a sewer conduit having means (8) for positioning the apparatus (3) opposite an unwanted side opening (2), particularly a disused branch pipe, and means (9, 12) for supplying concrete mass to the side opening (2), characterized in that the means (9, 12) for supplying concrete mass comprise at least one concrete supply tube

(9) which at the concrete outlet (12) under formation of a soft curve directs at least one orifice (12) against the inner wall of the sewer conduit (1).

6. An apparatus according to claim 5, characterized in that, under formation of soft bends, a concrete supply tube (9) branches into two or more concrete outlets (12, 12', 12") directed towards the inner wall of the sewer conduit.

7. An apparatus according til claim 5 or 6, characterized in that the concrete supply tube (9) is integral with the concrete outlet or outlets (12).

8. An apparatus according to one or more of claims 5-7, characterized in that curved flanges (16) are provided at the concrete outlets or orifices (12).

FIG. 1

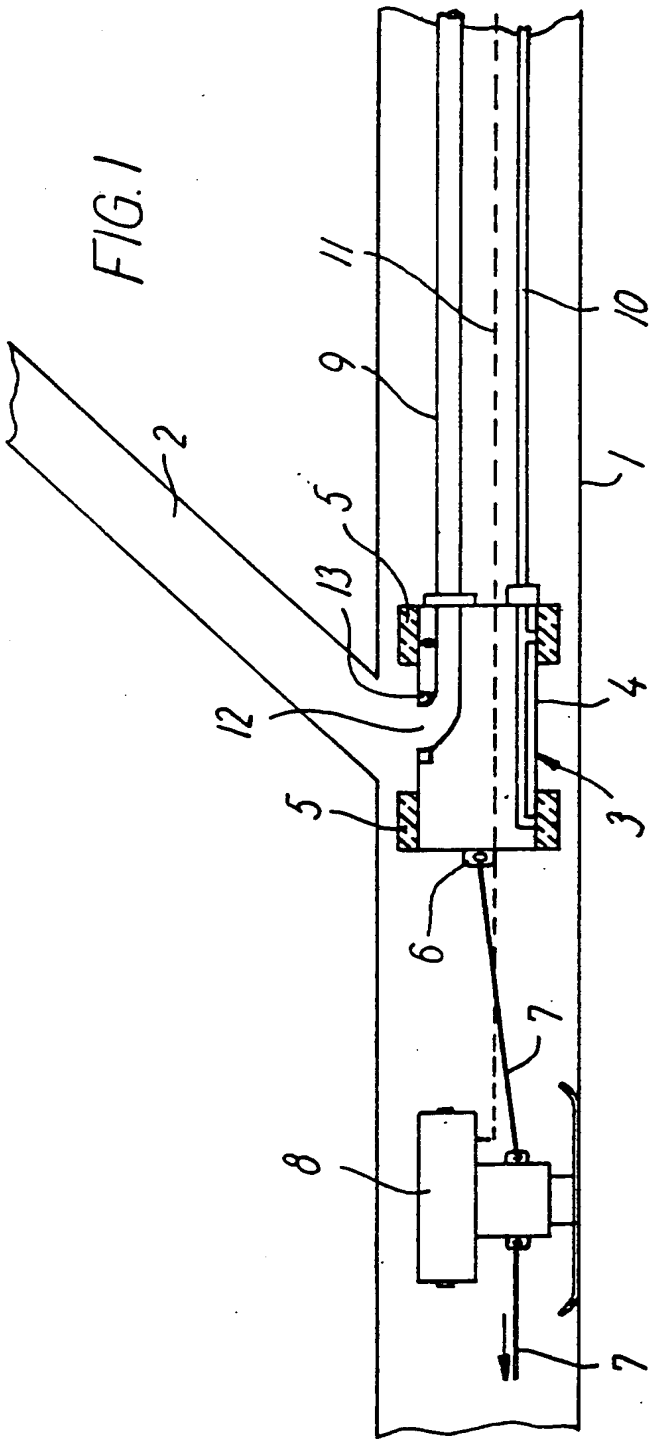
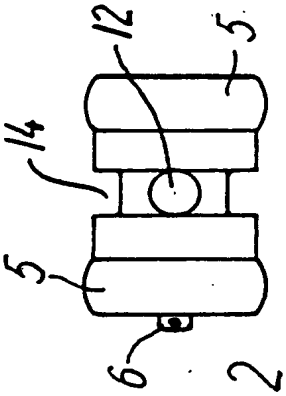


FIG. 2



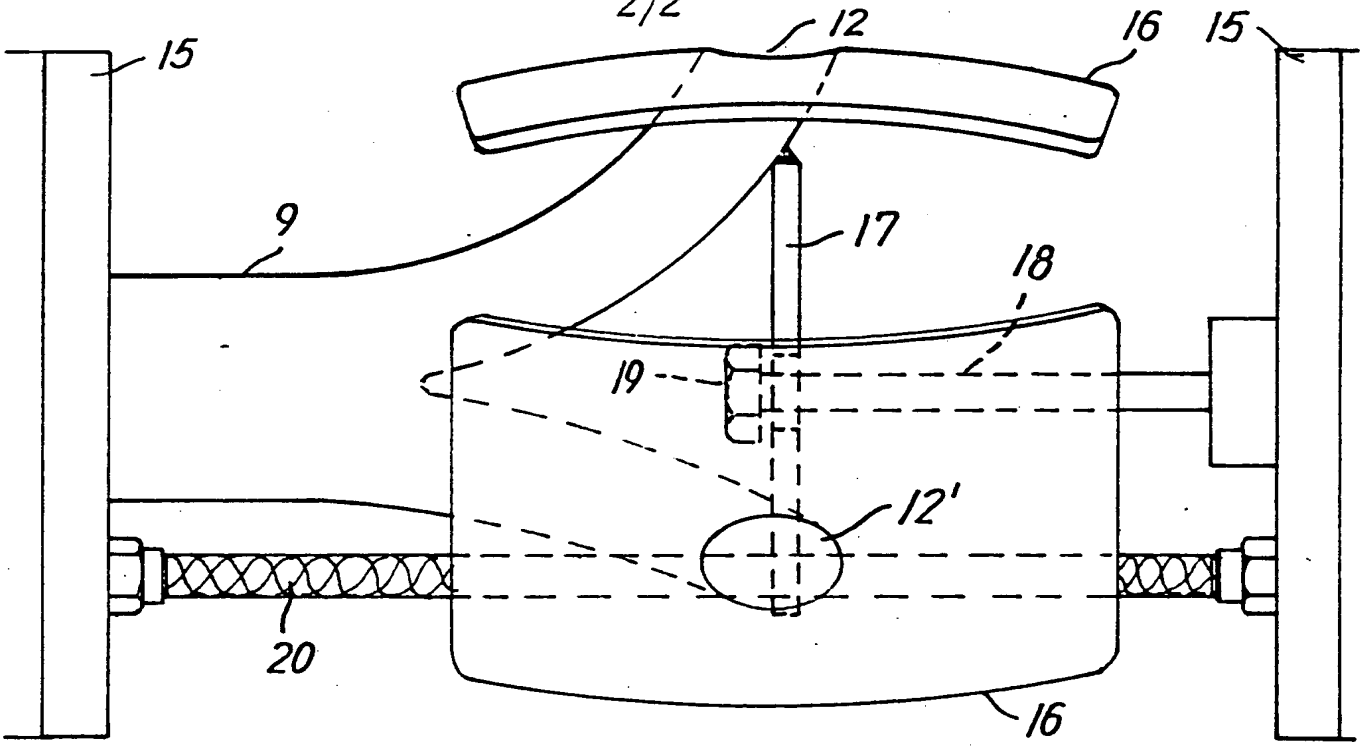


FIG. 3

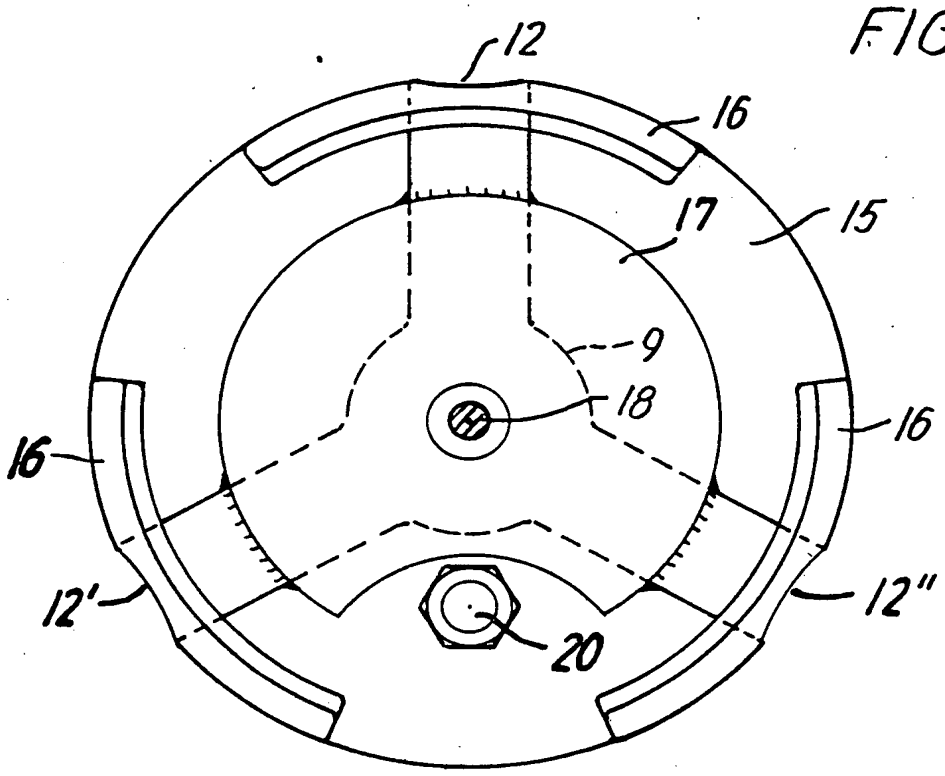


FIG. 4

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
Y	US, A, 3 267 967 (K.R. GUTHRIE) 23 August 1966	1
Y	US, A, 3 762 446 (B.F. TUNGSETH ET AL) 2 October 1973	1
Y	US, A, 3 834 422 (R.E. LARSON) 10 September 1974	1
Y	US, A, 3 946 761 (W.B. THOMPSON ET AL) 30 March 1976	1

INTERNATIONAL SEARCH REPORT

International Application No PCT/DK85/00013

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC [4]

F 16 L 55/16

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	F 16 L 55/00, 16, 18
National Cl	47f:1/70
US Cl	138:97-99

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	NO, B, 137 291 (GRANIT OCH BETON AB) 24 October 1977	1, 5, 6
Y	DE, A1, 2 635 866 (SANDELL, BERTIL) 24 February 1977 & FR, 2320917 US, 4092737 CH, 611831 GB, 1549299 JP, 53019340 SE, 419308 SE, 7508720	2
Y	GB, A, 1 331 602 (WILLIAM PRESS & SON LTD) 26 September 1973	1
Y	EP, A1, 0 096 958 (APPLETON, WILLIAM JOHN) 28 December 1983 & GB, 2122300	1
Y	US, A, 3 103 235 (E.B. STRINGHAM III) 10 September 1963	1

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* Special categories of cited documents: [10]

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Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
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International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Axel Lindhult

L.E.